

Building Code Compliance Packages Gaining Acceptance for Alternatives

A Presentation by the
Development Center for Appropriate Technology (DCAT)

in conjunction with the

Building Science Consortium of Building America

for the

The National Workshop on State Building Energy Codes
June 23 - 26, 2003 - Atlanta, Georgia



The Need for Change

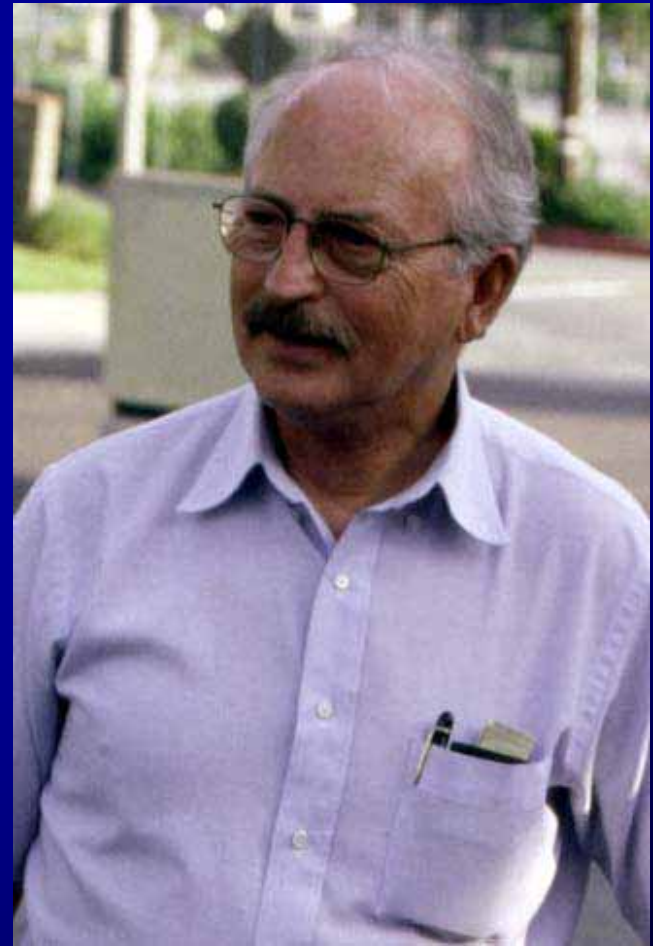
Since 1996 DCAT has been working to facilitate building code acceptance for more sustainable materials, designs and methods of construction.

Our program, *Building Sustainability into the Codes*, has been revealing that safeguarding the public health, safety and welfare includes responsibility for a much larger set of risks and impacts from buildings than just those occurring at the building site or in the present timeframe.

We've Not Been Alone in Seeing This...

“Safety is very important, but we need to think about the responsibilities for our collective safety; especially the welfare of future generations who, it’s worth noting, are unable to represent their interests.”

- the late Bob Fowler, P.E.,
FAIA, C.B.O., Founder and
Founding Chairman of the
Board of the International
Code Council



International Building Code 2000 edition

101.3 *The purpose of this code is to establish the minimum requirements to safeguard the public health, safety and general welfare through structural strength, means of egress facilities, stability, sanitation, adequate light and ventilation, energy conservation, and safety to life and property from fire and other hazards attributed to the built environment.*

Awareness - One Part of Our Strategy

Recognizing & balancing this larger set of risks related to buildings creates the foundation for widespread acceptance of code requirements for such things as:

- building energy performance
- indoor air quality, and
- addressing the environmental impacts of buildings.

Once aware of these risks, code officials can see this as part of their core responsibility to safeguard the public from hazards attributed to the built environment.

Capacity Building - The Other Part

Once there is recognition of the need for change, the next step is to build the capacity for change. The key elements of this process are:

- Education and Training for code officials
- Developing information resources
- Developing technical resources

For a variety of reasons, this isn't always enough...

Building the Capacity for Change

REALITY - Innovation and change in design and construction is usually slow and daunting.

REALITY - The same regulations designed to minimize negative outcomes often serve as barriers to positive change.

REALITY - Some recent innovations based on building science and other efforts to reduce the environmental impacts of buildings conflict with building code requirements.

Building the Capacity for Change

REALITY - In some cases, those designing and building with alternative designs, materials and methods don't understand them adequately...

REALITY - ...Neither do the code officials.

REALITY - This leads to lengthy and sometimes unsuccessful code approval processes, quality problems or failures in the field, and greatly extended timeframes for acceptance or outright rejection of viable and beneficial alternatives.

What's Needed

An effective solution to this problem would be to package all the critical information about an alternative needed on either side of the building regulatory counter in a user-friendly form and make it easily available to whoever needs it.

The Building Code Compliance Package!

What Information is Included?

- Problem Statement/Need for the Alternative
- Relevant Existing Code Provisions
- Building Science/Technical Basis for the Alternative
- Detailed Description of the Alternative
- Supporting Research Results, Test Data (or referenced summary)
- Criteria Recommended to Accept the Alternative
- Recommended Specifications and/or Details
- Specific Guidance for Plan Reviewers and Inspectors
- Suggested Code Change Language

An Example: Conditioned, Unvented Crawl Spaces

The need for Conditioned, Unvented Crawl Spaces

Building Science Consortium
Foundation and Building School

Building Code Compliance Information for Conditioned, Unvented Crawl Spaces

■ **The Need to allow Conditioned, Unvented Crawl Spaces**

The basic requirements for crawl spaces were first mandated from early recognition of moisture problems in basements and crawl spaces. The requirements were to manage the control of the accumulation of water vapor and condensation by requiring permeable vapor barriers through vapor barriers and/or by requiring a vapor barrier and/or ground cover. However, moisture problems can occur when climate or other conditions allow moisture to enter through the vapor barrier or when the vapor barrier is damaged or not properly installed.

There are two basic methods to manage for conditioned crawl spaces to avoid moisture problems. Both methods require controlling ground moisture. One is to design a crawl space to be conditioned, unvented, and/or sealed. The other is to design a crawl space to be conditioned, unvented, and/or sealed. The first method is to design a crawl space to be conditioned, unvented, and/or sealed. The second method is to design a crawl space to be conditioned, unvented, and/or sealed.

Moisture problems and poor indoor air quality affect a significant number of new buildings constructed over crawl spaces. Some problems are the result of poor workmanship and construction but others are the result of poor design and a lack of understanding of moisture dynamics. Ground covers frequently are installed incorrectly in that they are not continuous or sealed to the perimeter walls and joists. The floor of the crawl space is frequently irregular and covered with dirt, debris, and construction debris that proper installation of the ground cover is virtually impossible. Subsequent work occurring in the crawl space often results in damage to the ground cover allowing ground moisture to enter the crawl space. Because this is the case, it is considered desirable to seal the crawl space and provide it with effective drainage.

Proper design, construction, and maintenance of the crawl space is essential to the health and safety of the building. The crawl space is a critical part of the building and should be designed, constructed, and maintained accordingly. The crawl space is a critical part of the building and should be designed, constructed, and maintained accordingly.

supply ducts in the crawl space should be as close as possible to the crawl space. Air conditioning equipment and other equipment in the crawl space should be as close as possible to the crawl space. Air conditioning equipment and other equipment in the crawl space should be as close as possible to the crawl space.

When air distribution ducts and air handlers are placed in a crawl space, they contribute to moisture problems in several ways. Air ducts should be sealed or insulated and air handlers should be properly sealed. They should be properly sealed to the typical moisture barrier. They should be properly sealed to the typical moisture barrier. They should be properly sealed to the typical moisture barrier.

When basements built over crawl spaces in the United States today have cooling systems that deliver cooled air through ducts located in the crawl spaces. This means that the crawl space is a conditioned space. The crawl space is a conditioned space. The crawl space is a conditioned space.

An Example: Conditioned, Unvented Crawl Spaces

Relevant existing code provisions

Technical basis for conditioned crawl spaces

[illegible]

- *Relevant Existing Code Provisions*

The 1000 and 1003 address of the International Residential Code (IRC) includes the following provisions related to crawl space construction and ventilation:

Section FD-16 (Instructions to Agent) - **Field Office**[illegible]

Keywords:

1. to construct a means measure or frequency will also change the number.
2. When a transformed data are given a standardized nullow measure to average.
3. to compare standard with normal. In Table (10)171. (Chiou-Zone by Same and Same - J. A measure of normality is also required to find a normality. (10)171, Zone 7-3 and 10-171 Zone 11-171 and 10-171 Zone 11-171.

FOCUS Under-Place Space

XXXX.1 Venti-hall. The under-floor space between the bottom of the floor joists and the sub-floor joist building (except space occupied by a basement or cellar) shall be provided with ventilation openings through foundation walls or exterior walls. The maximum area of the ventilation openings shall not be less than 1 square foot for each 150 square feet (0.67 m² for each 1000 ft²) of under-floor joist area. Cross wall ventilation opening shall be within 3 feet (914 mm) of each corner of said building.

FIGURE 2 Coverage for under-floor ventilation. Ventilation openings shall be covered for floor temperature with wire mesh of the following dimensions provided floor surface dimensions of the coverage shall conform to 114.10(c) (6) (a) (i):

1. Perforated lower orbital plate or less than 0.075 inch (1.9 mm) thick.
2. Expanded lower orbital plate or less than 0.047 inch (1.2 mm) thick.
3. Carinae grille or grating.
4. Bonded lead-bearing brick veneer.
5. Handwired ducts of 0.055 inch (0.69 mm) wire or heavier.
6. Corrosion-resistant wire mesh, with the least dimension being 1/16 inch (2 mm) thick.

Energy Policy
12 (1984) 109-114

1. Vibration was induced by electric coordination, vibration on a special device

- [illegible]

(11101.3) Cover spaces. When a cover (downward) space is considered, functions shall be defined as follows: $\text{down}(\text{space})$ will be covered with $\text{down}(\text{space})$ to surround it. The required $\text{down}(\text{space})$ will be applied to the cover space wall, downward from the planar line corner located at the level and zone vertically and for horizontal distance in addition 14 inches (355 mm). The required $\text{down}(\text{space})$ will be covered with a continuous vapor barrier having a minimum permeance rating of 0.1 gper (0.57 mg/30" \times 24" \times 1/2"), when used to cover joints with A-50, 1/2".

41607.4 Used-in-place placement. An under-floor placement is a supply placement that conforms to the requirements of this section. Fuel gas lines and plumbing waste cleanouts shall not be located within this space.

4.1601.4.3 General: The prepared wall thickness of loose combustible materials and debris shall be properly reduced. The ground surface of the prepared wall be covered with a minimum 1/2 inch layer of concrete having a minimum thickness of 4 mils (0.1016 mm).

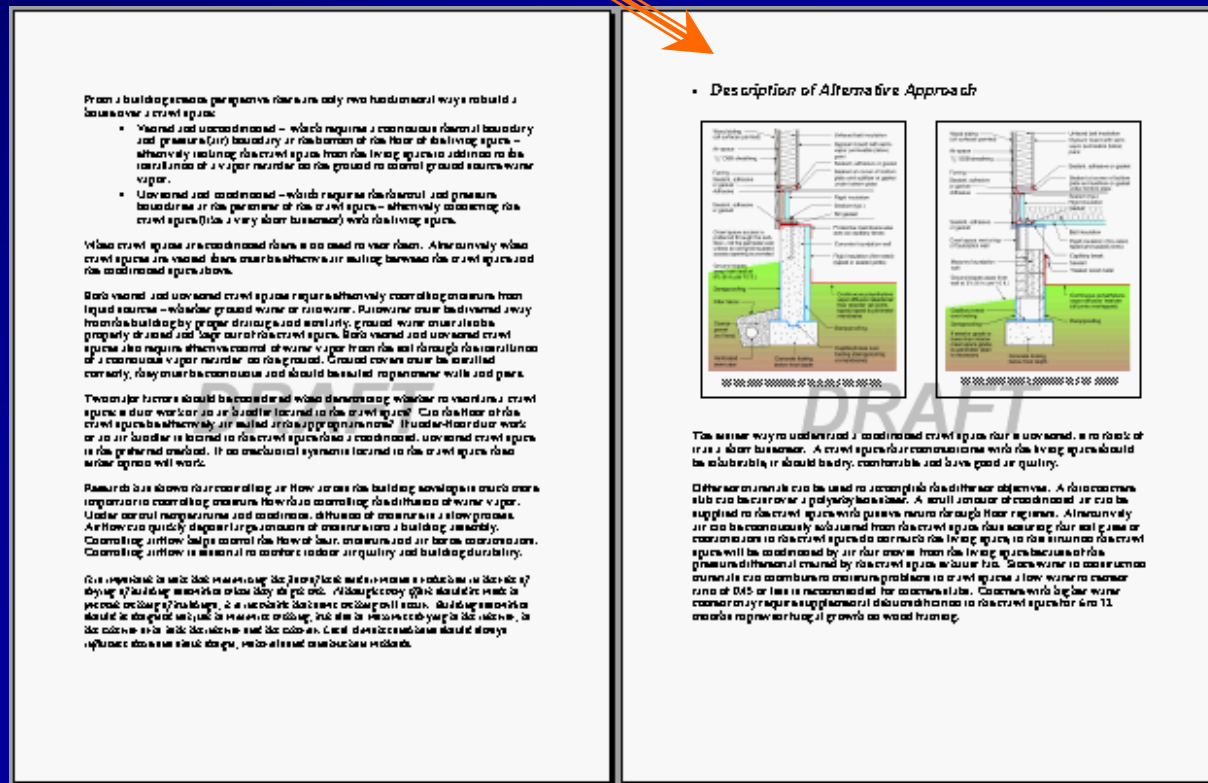
- **Technical Basis for Conditioned, Unvented Crawl Spaces**

[illegible]

Successful management of moisture in crawl spaces requires a diagnostic, comprehensive approach addressing both ground source of moisture and air flow across the building envelope. The required addressing liquid water source and water vapor source. Vapor and unvented crawl spaces can be properly built in dry climate zones providing rainfall flow of water. Air and moisture are properly controlled.

An Example: Conditioned, Unvented Crawl Spaces

Description of Alternative approach



An Example: Conditioned, Unvented Crawl Spaces

Supporting Research Results and Data

Recommended details and Specifications

■ Supporting Research Results, and Data

(For review and details of perimeter details data and other supporting evidence of the viability of crawl spaces, see the following research report: *Research Report*)

A crawl space foundation is a wall foundation where the above-grade floor is deemed or where a under floor space is needed for mechanical systems. This is a reversible strategy for conditioning crawl spaces: unconditioned, vented and ultimately insulated from the living space or conditioned to where the air is unconditioned. Control of ground moisture is essential to both strategies: foundation drainage and a properly sealed ground cover. In a unconditioned, vented crawl space insulation is installed under the floor and a air barrier is installed on the outside of the floor framing. In a conditioned crawl space the air barrier is installed on the inside of the floor framing and the air barrier is installed on the outside of the floor framing. A small volume of conditioned air is provided to the crawl space by a direct supply or indirectly by sub-slab air from the crawl space. A conditioned crawl space is unvented is recommended where mechanical systems and air distribution ducts are located within the crawl space. This design maintains the unconditioned insulation at unconditioned air from the air distribution system and reduces the probability of condensation on cold surfaces. A conditioned crawl space provides a secondary air barrier, but also provides a building barrier to provide occupant comfort and a low probability of environmental problems.

■ Criteria Recommended for Approval

A crawl space foundation is a wall foundation where the above-grade floor is deemed or where a under floor space is needed for mechanical systems. This design maintains the crawl space for conditioning crawl spaces: unconditioned, vented and ultimately insulated from the living space or conditioned to where the air is unconditioned.

Control of ground moisture is essential to both strategies: foundation drainage and a properly sealed ground cover. In a unconditioned, vented crawl space insulation is installed under the floor and a air barrier is installed on the outside of the floor framing. In a conditioned crawl space the air barrier is installed on the inside of the floor framing and the air barrier is installed on the outside of the floor framing. A small volume of conditioned air is provided to the crawl space by a direct supply or indirectly by sub-slab air from the crawl space.

A conditioned crawl space is unvented is recommended where mechanical systems and air distribution ducts are located within the crawl space. This design maintains the unconditioned insulation at unconditioned air from the air distribution system and reduces the probability of condensation on cold surfaces. A conditioned crawl space provides a secondary air barrier, but also provides a building barrier to provide occupant comfort and a low probability of environmental problems.

■ Recommended Specifications and/or Details

The minimum of a conditioned crawl space (as shown in Fig. 3) are:

- Effective design of ground water
- Ground cover barrier continuous and sealed to the perimeter walls and piers
- Insulation applied to the perimeter walls
- Airtight air barrier on the exterior - effective air sealing of perimeter walls
- Sealed air distribution ducts
- Conditioned air is provided to the crawl space
- Only sealed combustion appliances are installed

Details for a Vented, Unconditioned Crawl Space

The main way to build a vented, unconditioned crawl space is to build it as a basement or garage. The building envelope is located at the outside of the floor slab. Effective air sealing is required on the floor slab to prevent air from the living space from entering the crawl space. The minimum of a vented crawl space (as shown in Fig. 4) are:

- Effective design of ground water
- Ground cover barrier continuous and sealed to the perimeter walls and piers
- Insulation installed under the floor
- All plumbing is within the floor cavity or well sealed
- All air distribution ducts within the floor cavity or in the exterior of the basement
- A continuous air barrier is installed on the underside of the floor framing

Specific Guidance for Plan Reviewers and Inspectors

PLAN REVIEW CHECKLIST

- Effective design of ground water
- Ground cover barrier continuous and sealed to the perimeter walls and piers
- Insulation applied to the perimeter walls
- Airtight air barrier on the exterior - effective air sealing of perimeter walls
- Sealed air distribution ducts
- Conditioned air is provided to the crawl space
- Only sealed combustion appliances are installed

INSPECTION CHECKLIST

- Effective design of ground water
- Ground cover barrier continuous and sealed to the perimeter walls and piers
- Insulation installed under the floor
- All plumbing is within the floor cavity or well sealed
- All air distribution ducts within the floor cavity or in the exterior of the basement
- A continuous air barrier is installed on the underside of the floor framing

Criteria for approval

Review & Inspection Checklist

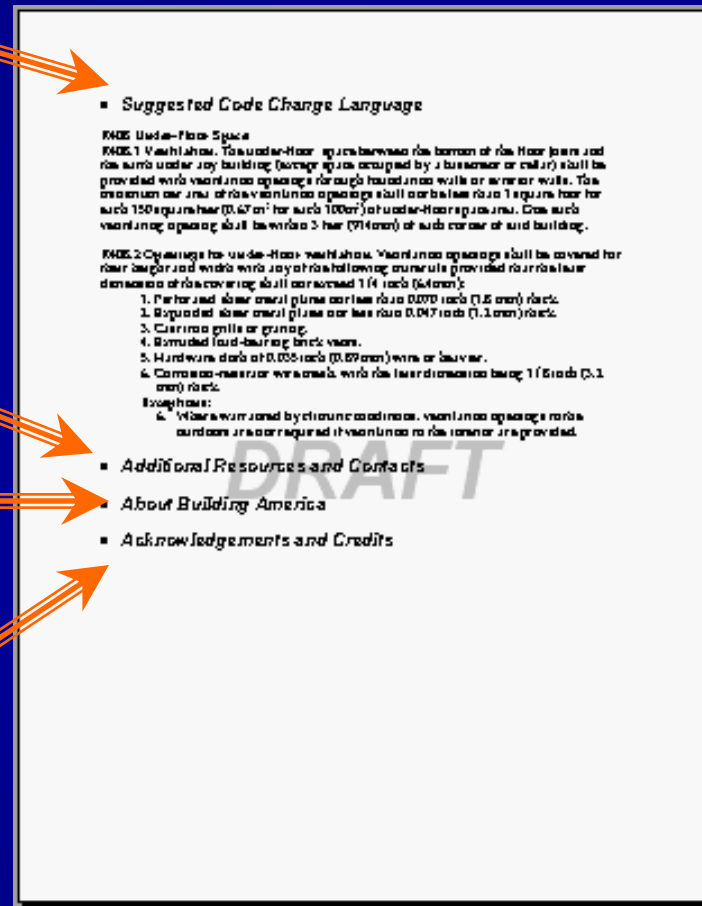
An Example: Conditioned, Unvented Crawl Spaces

Suggested Code
Change Language

Additional Resources
and Contacts

About Building America

Acknowledgements
and credits



Next Steps

There are enormous potential benefits to accelerating the acceptance and proper design, construction, code approval and use of many innovations and alternatives to mainstream building practice.

By providing accurate, useful, and easily accessible information to designers, builders, building owners and operators, and the building regulatory community this goal can be met effectively.

We are seeking support and partners to develop a range of these information packages for alternative designs, materials, methods, equipment and systems.

Next Steps

Among the organizations we are approaching in the development of these code compliance packages is the International Code Council. It is our hope that they can be developed in partnership with ICC to help ensure credibility, widespread acceptance, and use, as well as to streamline the code change process where appropriate changes are identified.

It is also hoped that this process will accelerate the development of a strong partnership between the building science and building codes communities.

For More Information

For more information about this project please contact:

David Eisenberg
Development Center for Appropriate Technology
520-624-6628
Strawnet@aol.com

Peter Yost
Building Science Corporation
Building Science Consortium of Building America
802/254-3663 or 978-589-5100
peter@buildingscience.com